ATCO Gas and Pipelines Ltd. (South)

Request for Technical Approval to Insert Composite Pipe into Existing House Mountain Transmission Pipeline

Swan Hills Area

February 19, 2015

Alberta Utilities Commission
Decision 19756-D01-2015
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Application 1611130-1

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1 Introduction

1. ATCO Gas and Pipelines Ltd. (South) (ATCO) filed a request with the Alberta Utilities Commission seeking technical approval to insert 101-millimetre (mm) reinforced composite pipe into the existing, and currently out of service, 114.3-mm House Mountain transmission (HMT) pipeline pursuant to Section 10 of the *Pipeline Rules*.[1] The HMT pipeline is governed by Section 4.1 of the *Gas Utilities Act*. The proposed composite pipe utilizes a thermoplastic liner, a helically wound reinforcement layer and an external thermoplastic jacket.

2. If the Commission grants the technical approval for the composite pipe insertion, ATCO would file an application pursuant to Section 4.1 of the *Gas Utilities Act* and Section 11 of the *Pipeline Act* seeking approval to construct and operate the replacement pipeline.

3. This request was registered as Application 1611130-1 on December 31, 2014.

2 Background

4. The 54.3-kilometre HMT pipeline was installed in 1974 and transported solution gas from producers at House Mountain receipt (1-8-70-10-W5) and Inverness River receipt (2-29-69-10-W5) to Judy Creek control station (15-25-64-11-W5). From Judy Creek control station, the natural gas was delivered to Edmonton markets by way of the Swan Hills transmission pipeline. The HMT pipeline also supplied natural gas to the Swan Hills miscible injection delivery (2-6-67-10-W5).

5. The HMT pipeline has had a recent history of local slope stability related problems. ATCO described that the HMT alignment runs north-south and crosses four major river systems deeply incised into the Swan Hills Upland. These river systems are separated by three narrow ridges or upland areas. The valley slopes of these major rivers are covered with widespread deep-seated landslides. In many cases, these landslides can be more than a kilometre long and tens to hundreds of metres high. They are often located at the crest of the uplands, leaving very little terrain unaffected by past land sliding.

6. In 2012, the HMT pipeline ruptured along Moosehorn Hill. The pipeline was replaced along the hill and strain gauges were installed to monitor pipeline integrity. A failure analysis of the ruptured pipeline indicated that the pipeline failure occurred as a result of circumferential stress corrosion cracking (CSCC). ATCO determined that the disbondment of the original tape coating, coupled with the tensile stresses induced on the pipeline from the movement of the slope were the cause of the CSCC. Subsequent flame ionization surveys completed in 2013 detected

[1] *Alberta Regulation 91/2005* under the *Pipeline Act*.

three additional leaks. These segments of pipe were cut out and replaced. Failure analyses of the damaged pipeline segments determined that the cause of these leaks was from CSCC. Again, the CSCC resulted from the disbondment of the original tape coating and stresses incurred from local slope instability. ATCO also discovered another leak in 2013, which was cut out and replaced. Failure analysis indicated the leak was a result of corrosion.

7. In November 2013, ATCO removed the HMT pipeline from normal operating service until it could be operated safely.

8. In July 2014, ATCO proposed to insert composite pipe into the existing HMT pipeline, but in the interim, temporarily return the HMT to operating service, at a reduced operating pressure, until the composite pipe project commenced. However, in August 2014, strain gauges installed on the HMT pipeline along Moosehorn Hill indicated possible plastic deformation of the pipeline installed in 2012 as a result of slope movement. With this new information, ATCO determined that the HMT pipeline could not be returned to normal operating service, and withdrew the request to the AUC.

9. On September 12, 2014, ATCO requested confirmation that the AUC would consider an application for composite pipe insertion. The AUC responded on September 15, 2014, stating that the AUC would consider an application for composite pipe insertion and recommended that such an application should address issues including:

1. Demonstration of the acceptability of composite pipe for gas utility pipeline use in the context of Canadian Standards Association (CSA) Standard Z662 - *Oil and Gas Pipeline Systems*, including Clause 13.1.1.3.

2. Demonstration that adequate insertion spacing exists to allow an 88.9-mm (subsequently clarified by ATCO to be 101 mm) composite pipe to be inserted into the 114.3-mm steel pipe without damaging the composite pipe.

3. Demonstration of procedures to support the piping or otherwise mitigate pipe shear at the bell holes where the carrier pipe will be cut and the composite pipe inserted.

4. Demonstration that the pipeline can be safely installed and operated for the intended application.

5. Demonstration of an integrity management program to deal with terrain slope stability with a composite pipe insertion.

10. The HMT pipeline has not been placed back into service because of the pipeline integrity concerns. ATCO added that, as a result, the solution gas was being flared or trucked from the production facilities.

3 Details of the composite pipe proposal

11. As mentioned above, the HMT pipeline is located in rugged terrain in an isolated area of north-central Alberta. ATCO has determined that the existing pipeline cannot be returned to service because of integrity issues, so an alternative is required to provide service for the existing customers in the area. Currently, there is no industrial or residential growth forecast for this area.

This pipeline is in a Class 1 location as defined in CSA Z662, with only private lease road crossings. There are no residences within 200 metres of this pipeline.

12. ATCO described that the difficulty in assessing the geohazard or risk to this infrastructure is that some of the old landslide terrain is presently stable or not experiencing ground movement. But, in those old landslide areas that are unstable, many are only experiencing small ongoing deep-seated creep-like deformation, typically less than 25 mm per year. ATCO added that the steep headscarps and mid-slope scarps are typically steep and of weak (bentonitic) bedrock, which is often exposed or is shallow in these areas. These conditions can lead to localized shallow instabilities within the larger old landslide mass, such as exists at the Moosehorn Hill rupture (i.e., small shallow landslides within a much larger landslide mass). Slope instabilities are dynamic and conditions are continually changing.

13. ATCO summarized its reasons for proposing a composite pipe insertion into the existing steel pipe as the best replacement solution as follows:

- Insertion of a composite pipeline into the existing steel pipeline would allow the majority of the geotechnical forces to be borne by the existing steel pipeline (casing pipeline).
- The composite pipe can accommodate more movement than steel pipelines.
- The composite pipe insertion is the least cost alternative when compared to a steel replacement or an integrity intensive alternative. Both of these alternatives are discussed in ATCO's general rate application submission – Application 1611077, Proceeding 3577.
- Monitoring on regular intervals would be completed to ensure electrical continuity along the casing. This is a proactive approach to addressing the additional forces on the pipeline created by slope instability.
- Composite pipe does not corrode.
- It would be difficult for an integrity intensive or replacement alternative to fully address the slope instability in the area, given the unpredictability of the geological setting.
- Minimal construction disturbance compared to other replacement alternatives.
- The HMT pipeline does not have the need for multiple taps along the pipeline, as typically required for a transmission pipeline.

14. The insertion procedure would involve pulling multiple sections of coiled composite pipe, each less than one kilometre in length, through the existing steel pipeline.

15. ATCO addressed the issues identified in the Commission's letter of September 15, 2014, as follows.

3.1 Compliance with CSA Z662 - Oil and Gas Pipeline Systems

16. ATCO referenced that CSA Z662-11, Clause 13.1.1.3 states the following:

> Except as allowed by Clause 12.4.6, reinforced composite pipe may be used only in LVP, gas gathering, multiphase, and oilfield water pipelines.

17. Regarding composite pipe, Clause 12.4.6 states the following:

> Continuous length reinforced thermoplastic pipe (RTP) Type 1 may be installed in distribution systems in accordance with the requirements for RTP pipelines in Clause 13.1, except that the maximum pressure rating (MPR) in the design equation in Clause 13.1.2.8 shall be established on the basis of a minimum life expectancy of 50 years. The requirements as specified in Clause 13.1.1.3 do not apply.

18. ATCO submitted that as Clause 12.4.6 falls under Section 12 – Gas Distribution Systems, composite pipe, i.e., reinforced thermoplastic pipe would be allowed for use in distribution pipelines, as defined by CSA Z662, subject to Clause 12.4.6.

19. However, ATCO acknowledged that Clause 13.1.1.3 does not include the use of composite pipe for gas transmission lines as defined in CSA Z662. Nonetheless, ATCO further expressed the perspective that this particular pipeline application is analogous to a gas gathering pipeline as follows:

> With respect to the definitions in CSA, the HMT is a transmission pipeline; however, from a technical perspective the functionality of the HMT is similar to a pipeline characterized as gas gathering. The operating conditions seen in a gas gathering pipeline are similar to the HMT (high pressure gas). Also, the performance of composite pipe does not differ between a gas gathering pipeline and a transmission pipeline.[2]

20. ATCO also submitted that clauses 1.4 and 1.8 in CSA Z662-11 describe the intent of the standard, and that it is to be used with "good engineering judgment" and it is "not the intent of this Standard to prevent the development of new equipment or practices." ATCO stated that it proposed composite pipe insertion because it the best option to address the ongoing integrity issues of the HMT pipeline that result from the unique challenges of the geotechnical setting of the area. ATCO requested that the AUC recognize the intent of the CSA Z662 standard, and evaluate ATCO's proposal on its technical merit.

21. ATCO pointed out that the Commission has approved the use of composite pipe for AltaGas Utilities Inc. in 2010 and 2011, and that the Alberta Energy and Utilities Board approved the use of composite pipe in 2007. ATCO also referenced that various Alberta gas co-ops have also installed more than 104 kilometres of Flexpipe in high pressure (>100 psi) in providing natural gas service. ATCO considered that these installations were for gas transmission service.

3.2 Adequacy of insertion space

22. ATCO explained that installation of the composite pipe would be completed by digging bell holes along the existing right-of-way. The pipeline would be exposed and a portion of the

[2] Exhibit 19756-X0002, Round 1 IR Responses, Response to IR 1(b), page 2 of 3.

pipeline would be cut out to allow for the insertion of the composite pipe. Sections of the composite pipe would then be connected using hydraulically crimped connection fittings, the casings would be electrically bonded and the bell holes would be back-filled.

23. To explore the adequacy of the insertion space, ATCO consulted with Flexpipe, the proposed composite pipe vendor and also with ATCO's construction consultant. ATCO described that prior to inserting the composite pipe, the contractor would run a series of pigs or plates to clear the pipe of internal debris and weld slag. This would ensure that adequate spacing is consistent for the length of the proposed pull. A lubricant would then be applied to the composite pipe during insertion. For the majority of the pipeline length, there would be a clearance of six mm from the casing pipe (114 mm outside diameter x 3.6 mm wall thickness) to the composite pipe (101 mm). According to Flexpipe and ATCO's construction consultant, this is an adequate amount of clearance for a full spool pull (typically 730 metres); however, pull lengths can vary. For segments of the HMT pipeline with 4.8-mm wall thickness, there is only 3.7 mm of clearance. ATCO stated that this is an adequate amount of clearance to facilitate composite pipe insertion; however, it would likely result in the need to reduce the length of composite pipe that can be inserted. Required pull forces would be closely monitored during insertion to ensure that pull force tolerances are not exceeded. For each pull section, the contractor would complete a 10-metre test pull to verify that the pull could be completed without affecting the integrity of the composite pipe. In addition to this, the leading edge on all pull sections would also be visually inspected to ensure damage to the outer layer of high-density polyethylene is within the manufacturer's tolerances.

3.3 Pipe support procedures

24. Regarding the issue of pipe support procedures, ATCO stated that the soil underneath the location of the connection fitting should be left undisturbed, or properly compacted and that ATCO would ensure proper construction practices are followed. In addition, ATCO proposed to mitigate shearing potential by installing a channel iron (i.e., cradle) underneath the connection fitting between pipeline ends. This would restrict the connection fitting's movement and would ensure shearing is limited between the composite pipe and casing pipe.

3.4 Installation and operational safety

25. With respect to installation and operational safety perspectives, ATCO stated that it would adhere to the composite pipe manufacturer's installation procedures. These procedures would be closely monitored during construction to ensure the composite pipe would be inserted safely and would not jeopardize the integrity of the composite pipe. The composite pipeline would also be constructed in accordance with CSA Z662 requirements.

3.5 Integrity management program to deal with terrain slope stability

26. Regarding pipeline integrity management associated with the rugged terrain, ATCO stated that it has developed an integrity management plan that would be suitable for the HMT pipeline with composite pipe. The integrity management plan addresses the expected effects of the geotechnical hazards along the HMT pipeline. The integrity management plan includes in part:

- Leak detection surveys (flame ionization and/or aerial leak detection) would continue to be completed.

- Annual cathodic protection monitoring of pressurized steel components (valve assemblies and producer/customer tie-in points).

- Monitoring of anodes installed on composite pipe steel connection fittings.

- Electrical continuity surveys - At the composite pipe connection points, the ends of the casing pipe would be electrically bonded to each other through a test post to ensure electrical continuity along the casing for the pipeline. This would allow ATCO to conduct electrical continuity surveys to determine if the casing pipe has severed between two connection points due to geotechnical forces, in order to monitor the casing continuity and ensure the integrity of the composite pipe is maintained.

27. ATCO stated that it is also evaluating the potential benefit of utilizing strain gauge monitoring of the casing pipe along slopes that have a higher geological risk. Further details could be provided in ATCO's application for installation of the composite pipe if approved.

4 Findings

28. In making its decision on the request, the Commission has taken into account the following provisions of the *Pipeline Rules*:

> **9(2)** Except as otherwise specified by these Rules, the following standards are in force:
>
> (a) CSA Z245.11, *Steel Fittings*;
>
> (b) CSA Z245.12, *Steel Flanges*;
>
> (c) CSA Z245.15, *Steel Valves*;
>
> (d) CSA Z662, *Oil and Gas Pipeline Systems*.
>
> **(3)** Except as otherwise specified by these Rules, the minimum requirements for the design, construction, testing, operation, maintenance, repair and leak detection of pipelines are set out in CSA Z662.

29. Despite Section 9 of the *Pipeline Rules*, the Commission may approve, under Section 10 of the rules, the use of a polymeric or fibre-reinforced composite material for pipeline construction or repair, if the Commission is satisfied that the material proposed is acceptable for the proposed use.

30. The Commission has reviewed the technical information contained in the request for approval to use composite pipe in the HMT pipeline and ATCO's submissions regarding CSA Z662 and the use of composite pipe in this case.

31. The Commission observes that, based on the definitions in CSA Z662, the HMT pipeline is a transmission line. ATCO has also acknowledged that the HMT is a transmission pipeline.[3] The Commission is not persuaded by ATCO's submissions that the functionality of the HMT

[3] Exhibit 19756-X0002, Round 1 IR Responses, Response to IR 1(b), page 2 of 3.

pipeline is similar to a gas gathering line since it was constructed and operated as a transmission line. In addition, it does not fall within the definition of a distribution line.

32. Further, based on clauses 13.1.1.3 and 12.4.6 of CSA Z662, the use of reinforced composite pipe is acceptable under the CSA standard for a low vapour pressure pipeline, a gas gathering system or a distribution system, but not for a transmission pipeline. Further, the Commission does not accept ATCO's submission that the performance of composite pipe does not differ between a gas gathering pipeline and a transmission pipeline because the CSA standard does not support such a conclusion, as the CSA standard prohibits the use of composite pipe in a transmission pipeline.

33. In addition, given the specific circumstances of the HMT pipeline within steep and unstable terrain and the geohazards described above, the challenges of installing the composite pipe, and that it does not appear that composite pipe has been used in transmission pipelines, the Commission is not satisfied that composite pipe is a material that may be used in a transmission pipeline such as the HMT pipeline. Accordingly, the Commission denies the request to insert composite pipe into the existing steel pipe of the HMT pipeline. However, should the CSA Z662 - *Oil and Gas Pipeline Systems* standard change to allow the use of composite pipe material in a transmission pipeline, then the Commission would consider an application for the insertion of composite pipe into the existing HMT pipeline.

Dated on February 19, 2015.

Alberta Utilities Commission

(original signed by)

Neil Jamieson
Commission Member